



Possibilities of Computed Tomography and Magnetic Resonance Urography as Modern Techniques in the Diagnosis of Volumetric Ureteral Processes

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Annotation: Urothelial cancer is the 4th most common malignant tumor after prostate (or breast), lung and colorectal cancer. Transitional cell carcinomas of the upper urinary tract (UTC) are less common than those of the bladder, but 60% are diagnosed as early as stage III. Risk factors include tobacco smoking and professional activities (employment in the paint and varnish, chemical, oil industries). In addition, the ureters are secondarily involved in the volumetric processes of the abdominal cavity and especially the small pelvis. All patients underwent a comprehensive X-ray examination: ES was initially performed in 64.8% (n = 92), ultrasound in 67.6% (n = 96). All patients then underwent CTU and/or MRU.

Keywords: Urothelial cancer, abdominal cavity.

Intraduction. Various treatment options for patients with ureteral stones are presented, depending on size, localization of the stone and attack of pyelonephritis. Among patients with urolithiasis, up to 50% are persons suffering from urolithiasis with localization of stones in the ureters, which can cause renal colic, ureterohydronephrosis, acute obstructive pyelonephritis, obstructive anuria and a number of other complications. Urothelial cancer is the 4th most common malignant tumor after prostate (or breast), lung and colorectal cancer [3–5]. Transitional cell carcinomas of the upper urinary tract (UTC) are less common than those of the bladder, but 60% are diagnosed as early as stage III. Risk factors include tobacco smoking and professional activities (employment in the paint and varnish, chemical, oil industries) [3]. In addition, the ureters are secondarily involved in the volumetric processes of the abdominal cavity and especially the small pelvis. In a number of subjects, the use of ionizing radiation is difficult: these are patients who need multiple dynamic studies (especially young people), pregnant women, patients with reduced renal function, and people with allergic reactions to a contrast agent. In these situations, magnetic resonance urography (MRU) can become the method of choice, which makes it possible to establish the fact of uro-obstruction and suspect its cause [8–10]. MR examination of the urinary tract can be performed in 2 ways: in the form of static non-contrast urography using ultra-fast T2-weighted sequences (T2-WI) - such as in magnetic resonance MR-cholangiopancreatography, and using T1-WI after intravenous administration of a contrast agent (by analogy with X-ray EU). The method of non-contrast MRU is based on obtaining a high-intensity MR signal from a sedentary fluid located in natural and/or pathological structures in the study area, and

allows visualization of the urinary tract during their expansion, cysts of various localization, and the spinal canal. In 95% of cases, in the presence of a calculus less than 10mm in diameter, its independent discharge is likely within 4 to 6 weeks, and during this time it is possible to continue observation, conduct lithoextraction or drug therapy in the absence of clinical signs of pyelonephritis [15-18].

Materials and methods: 132 patients were under observation who were treated for diseases of the upper urinary tract (UTC) in Uzbekistan from 2018 to 2022.

All patients underwent a comprehensive X-ray examination: ES was initially performed in 64.8% (n = 92), ultrasound in 67.6% (n = 96). All patients then underwent CTU and/or MRU. Patients with primary tumors of the ureters (n = 12; 8.22%), as well as with secondary involvement of the organ in the volumetric processes of the small pelvis (n = 32; 21.9%) and patients with metastatic lesions of the lymph nodes (n = 2; 1.37%) were separated into a separate subgroup (n = 46; 31.5%). CTU on a 160-slice Aquilion Prime scanner was performed in 90.1% (n = 128), including 42 (91.3%) patients from the subgroup with mass lesions. Before the study, an allergic anamnesis was collected, information about previous studies using CV, the presence / absence of anaphylactoid reactions, the patient agreed to the study. Only non-ionic contrast agents (iodine concentration 200-350 mg/ml) were used to obtain intravenous bolus enhancement. During the study, a two-head injector was used, with the help of which 90-120 ml of a contrast agent (1.5 ml per 1 kg of patient weight) was injected into the cubital vein at a rate of 4 ml / s, after the end of the injection of the contrast agent, 50 ml of saline was automatically bolused, at the same speed. 30 minutes before the study, patients took 200-400 ml of non-carbonated drinking water, which improved the visualization of the abdominal cavity and prevented the imposition of contrasted loops of the small intestine. For a comprehensive assessment of the pelvic organs and the search for complications of interventions on the upper urinary tract, diffusion-weighted images (DWI) (with the construction of ICD maps) were mandatory for all patients. In the case of excretory urography, a contrast agent was injected. To fill the hollow urinary organs and thus better visualize them, 1–1.5 hours before the study, patients were recommended to drink 500 ml of non-carbonated water. All subjects were given a diuretic load in the form of furosemide 10 mg intravenously 15 minutes before the study; 30 minutes before the study, drotaverine 120 mg per os was used to reduce the number of motor artifacts. The superficial abdominal coil was fixed with straps. Patients with electrical or magnetic implants were not allowed to undergo MRI, in the case of excretory MRU - with a GFR < 30 ml/min/1.73 m². As a reference method, the results of computed urography (CTU), confirmed during surgery, were considered.

Results. The distribution of localization of pathological changes in the ureters in patients with space-occupying lesions. Analysis of the presented data shows that the lower third of the ureter (including the intramural part) was most often affected - in 74.1% (n = 34). Less common was the involvement of the upper third of the organ and LMP - in 17.24% (n = 8 people) and the middle third - 8.66% (n = 4). Results and its discussion. The distribution of localization of pathological changes in the ureters in patients with space-occupying lesions is shown in Table. 4. Analysis of the presented data shows that the lower third of the ureter (including the intramural part) was most often affected - in 74.1% (n = 34). Less common was the involvement of the upper third of the organ and LMP - in 17.24% (n = 8 people) and the middle third - 8.66% (n = 4). According to the radiation methods, obstruction of the organ at a certain level (n = 46; 100%;), filling defect (n = 8; 17.4%), supragenital expansion (n = 33; 71.7%), hydronephrosis (n = 35; 76.1%), enlargement of the renal pelvis (n = 29; 63.0%). The length of the filling defect or changes in the wall of the ureter and/or surrounding tissue varied from 2 mm to 7 mm. The reaction of pararenal, paraureteral tissue was noted in 58.7% (n = 27), fluid accumulation in the pelvis in 52.1% (n = 24). Additionally, there was a violation of the excretory function of the kidney in 26.1% (n = 12) of patients, the development of pelvic-renal reflux in 4.35% (n = 2).

The level of ureteral obstruction was correctly defined in all studies in both CTU and MRU. The high tissue contrast of MRI made it possible to detect retention of the upper urinary tract in 100% of cases and to establish a diagnosis without the use of contrast enhancement in a larger number of cases compared to MSCT (MRI allowed us to limit ourselves to a native study in 23.9% (n = 11) patients, MSCT – in 8, 7% (n = 4) Dilated urinary tracts were characterized by a hyperintense MR signal on T2-WI in static MRU, due to the high MR signal from urine, kidneys, ureters and bladder were visualized simultaneously. T2-WI with thick sections made it possible to obtain images in any plane and reconstruct MIP images from them. Lack of retention of the urinary tract reduced the effectiveness of native MRU due to insufficient amount of hyperintense fluid. Bilateral ureteropyelocalicectasia is noted (more on the right, the expansion of the ureter reaches 31 mm), thinning of the parenchyma of the right kidney. At the studied level, liver cysts and a cyst of the right kidney are also visualized.

Volumetric formations of the ureters were visualized as filling defects - in 5 (10.9 %) cases with MRU and 7 (8.7 %) - with CTU, of which in 4 (8.7 %) cases, the "cup" symptom (dilation ureter distal to the filling defect) . Direct primary soft tissue component was noted in 5 cases, both in CTU and in MRU. A comparative analysis of the possibilities of radiation diagnostic methods in determining the signs of transitional cell tumors of the ureters .Since ultrasound did not allow to identify specific signs, its results were not taken into account. The low sensitivity of ES at the stage of primary diagnosis was associated with the difficulty in obtaining adequate contrast enhancement of the ureters and, accordingly, with the difficulty in visualizing small (less than 15 mm) foci.

ES also did not allow differentiation of a blood clot from a urothelial tumor and did not show thickening of the organ walls, which explains the low specificity (82%).

Sprouting of the ureter by a tumor of the small pelvis was noted in 32 patients with MRU, in 29 with CTU. Standard sequences (including DWI and ADC-mapping) made it possible to visualize space-occupying formations, subsequent MRU to more accurately assess their boundaries and distribution, which is important when choosing a surgical approach (Fig. 6, a-d).

MRI also provided additional information in the form of an assessment of the state of the surrounding cellular tissue (infiltration was detected in 27 (58.7%) cases, the most sensitive sequence was series with fat suppression. An increase in the MR signal was noted on them periureterally.

MRU made it possible to detect changes in parenchymal organs, liver, adrenal glands and to suspect the presence of a secondary lesion of the pelvic bones (found in 6 cases). Pelvic effusion was equally well detected on both MRI and ultrasound (n = 12, 26.1%), and this is probably due to the brightness of radiation manifestations of free fluid accumulations. Standard T2-WI and fat-suppressed sequences made it possible to see fluid collections and differentiate them from, for example, ovarian cysts and follicles.

Conclusion. When pathological changes are localized in the lower third of the ureter, especially in its distal section/mouth, MRU can provide the most valuable diagnostic information - static and with subsequent contrast enhancement. In this case, MRU will make it possible to visualize the structures of the small pelvis well, to assess the state of the lymph nodes. If changes are found in the upper third of the ureter or the ureteropelvic junction, it is possible to obtain an adequate image of the urinary tract both with CTU and with the help of MRI and ultrasound. With the localization of the "zone of interest" in the middle third of the body, the most complete amount of diagnostic information can be provided by KTU.

MRU allows obtaining additional diagnostic information about the state of the organ wall and the infiltration of the surrounding tissue. The possibility of a comprehensive assessment of the organs of the abdominal cavity and small pelvis makes it possible to exclude other pathologies and affects the tactics of patient management.

The absence of ionizing radiation allows the use of MRU in pregnant women and children, in patients with reduced renal function. Considering the diagnostic efficiency similar to CTU, the technique can also be used for dynamic monitoring of treatment results.

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